

REPORT
COCOA AND COCONUT BASELINE
SURVEY
BOUGAINVILLE PROVINCE

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FOREWORD

The cocoa and coconut baseline survey has been the first comprehensive study ever conducted to obtain baseline information on the current status of smallholder cocoa and coconut activities in Bougainville. The purpose of this study is to make available baseline data to plan a major cocoa and coconut rehabilitation programme for Bougainville. The project was funded by the Stabex (EEC) and has been executed by the PNG Cocoa and Coconut Extension Agency (PNGCCEA).

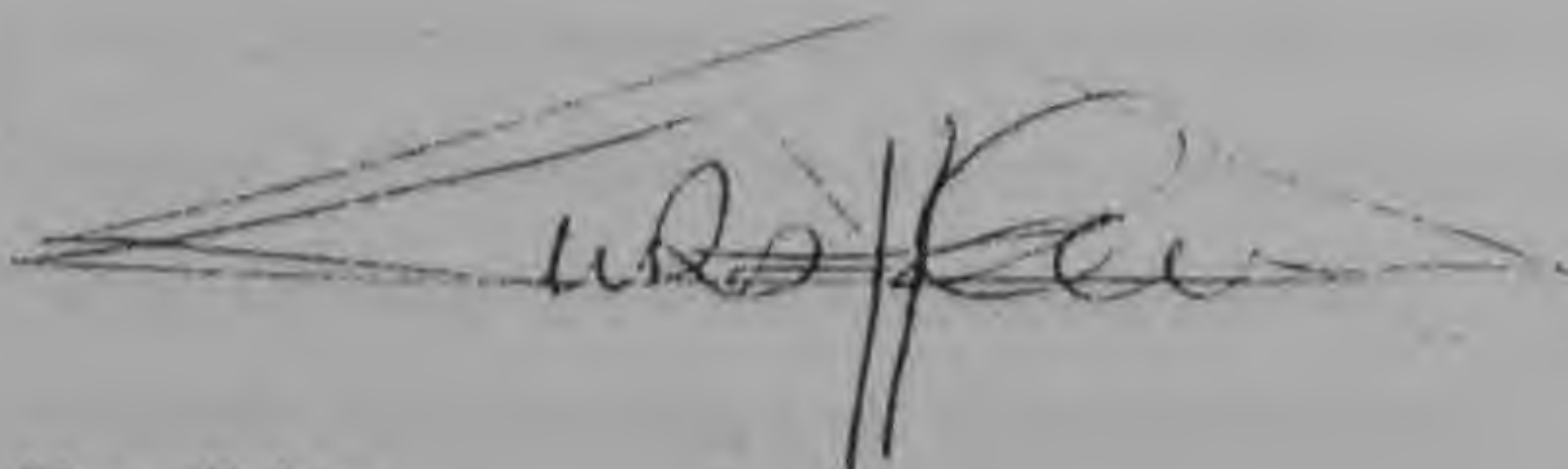
It is expected that the findings of the study would not only be useful to implement the rehabilitation programme but also for many others engaged in promoting other development programmes in the island. We do also hope that the study will pave the way for carrying out further useful research in this field.

A large number of people with various capacities were engaged in this study. To name them all would be impossible, to name none would be ungrateful. We sincerely acknowledge and appreciate their tireless and hard work put in for this important exercise.

The successful completion of this study was possible due to the untiring zeal and hard work of Assistant Secretary, Division of Primary Industry, Mr. Patrick Koles and Mr. Jacob Banas, Senior Cocoa Board Inspector and their staff. The National Extension Manager, PNGCCEA, Mr. Moses Woruba, Bougainville Provincial Extension Manager, Mr. Matthew Uremu, for planning, designing and developing the questionnaire and for guiding from time to time for the completion of the study. I would like to thank them for their hard work.

Finally, thanks are due to Messrs. Mizanur Rahman, the Principal Rural Statistician for the Department of Agriculture and Livestock and William Kondorr, the Rural Statistician for CCEA for conducting the entire operation of the study.

Should the findings of the study be useful in successful implementation of the rehabilitation programme on Bougainville, the time and energy spent would be deemed worthwhile.



Uron Salum

Executive Director

CONTENT

FOREWORD	PAGE
CONTENT	
SUMMARY	
COCOA AND COCONUT BASELINE SURVEY	
Introduction	1
Background	1
Objectives	2
Sample Design	3
Questionnaire	4
Enumerator	5
Quality Control	6
Analysis	6
Growers Characteristics	7
Estimation of Population Total	9
Cocoa households, current trees, areas and trees damaged due to crisis and drought	10
Coconut households, current trees, areas and trees damaged due to crisis and drought	11
Cocoa: Description of plantings	13
Coconut: Description of plantings	14
Future plan to extend cocoa block(s)	15
Future plan to extend coconut block(s)	16
Cocoa trees new or re-planted in the last 12 months	17
Coconut trees new or re-planted in the last 12 months	18
Cocoa: Labour assistance and unit cost paid per fortnight	19
Coconut: Labour assistance and unit cost paid per fortnight	20
Cocoa: Growers opinion on replacing old trees	21
Coconut: Growers opinion on replacing old trees	22
Source of cocoa seedlings	22
Source of coconut seed nuts	23
Cocoa: Spacing used in Planting	24
Coconut: Spacing used in planting	25
Condition of cocoa block(s), availability of tools and growers intention of cleaning cocoa block(s) soon.	26

Cocoa: Where learned Pruning	28
Cocoa: Reasons for not Pruning	28
Cocoa: Fermentary owning, registration number, dealer's license and condition of fermentary	29
Cocoa: Reasons for Fermentry not operating	30
Cocoa: Trees damaged by insects and diseases	31
Coconut: Trees damaged by insects and diseases	32
Cocoa seedlings damaged by insects and diseases	33
Coconut seedlings damaged by insects and diseases	34
Growers opinion on cleaning coconut block(s)	35
Coconut: Use of fertilisers	36
Copra dryers: Owning, type, condition and producer numbers	37
Copra dryers: Reasons for not operating	38
Conclusion	39
Recommendation	39
Reference	40
Appendix: Questionnaire	

SUMMARY

COCOA DETAILS

1. The survey reveals that well over 15,700 households are cultivating cocoa in Bougainville, either sole or inter-planted with coconut and other crops with an estimated total of 47,774 hectares of land giving an average of 3.04 hectares per household.
2. An estimated total of 12.7 million cocoa trees are currently standing in Bougainville, out of which 8.7 million are bearing, 2.2 million are immature while the rest, 1.9 million, are senile.
3. Trees destroyed during the crisis period were estimated to be 14.2 million, while 5.2 million were damaged as a result of the 1996 and 1997 drought in PNG.
4. Had there been no tree deaths, the actual number of trees in Bougainville would have been over 32.2 million, with an average of 674 trees per hectare.
5. Around (40.0%) of the cocoa growers had sole-planted while (57.2%) inter-planted with coconut and the rest inter-planted with other crops.
6. Nearly sixty per cent of the growers mentioned that they had plans to extend cocoa block(s) by planting an additional 13.7 million trees. To calculate the number of block(s) growers wanted to extend, simply divide the above number of trees by the estimated number of cocoa trees per hectare.
7. An estimated total of 2.0 million trees were new-planted by less than one-fourth of the growers in the last 12 months while (30.9%) of the growers re-planted a total of 4.5 million trees.
8. Paid labour was reported to be used by one-third of the growers. The average unit cost paid was K20 per fortnight. However, unit cost varied considerably from one district to another.

9. Over (90.0%) of the cocoa growers wanted to replace old trees, half of which wanted to do it within six months while little over one-fourth wanted within three months and the rest wanted within a year.
10. More than eighty percent (84.8%) of the growers used to receive cocoa seedlings from the CCRI/DPI, while (13.0%) mentioned own nurseries as the source of seedlings. Only (1.3%) sourced their seedlings from community nurseries.
11. Triangular/Square method was the most popular method of planting in Bougainville as over eighty five per cent of the growers indicated that they used the above method in cocoa planting. Only (12.0%) mentioned that they used simple row method.
12. Five out of every six growers cleaned their cocoa blocks. (97.6%) of the growers mentioned that they intended to clean cocoa blocks soon.
13. Nearly seventy per cent of the growers have pruned their cocoa blocks of which forty-five per cent mentioned that they learned pruning from the DPI Extension officer, while over one-third mentioned that they learned by themselves. The rest learned from neighbours.
14. Nearly forty per cent (39.5%) of the growers owned fermentaries. Two-third of them reported that the fermentaries were not operating. When we asked why their fermentaries were not operating, majority of them (66%) mentioned that their fermentaries were destroyed during the crisis.
15. Over eighty per cent of the cocoa growers stated that only leaves, pods and shoots were damaged by insects and diseases. Roots, branches, trunks and leaves were the major parts of the trees, damaged, as nearly fifty per cent of them indicated. Only (18.3%) of the growers stated leaves and branches.
16. Over half of the cocoa growers mentioned that their cocoa seedlings were also affected by insects and diseases. Leaves were the major parts of the seedlings damaged by insects and diseases as (27.3%) of them indicated. One-fourth of them stated trunks and leaves while (13.0%) indicated root/leaves and branches.

COCONUT DETAILS

17. An estimated total of 8,100 households were involved in coconut cultivation in Bougainville, covering a total of 32,382 hectares of land. This gave an estimated average of 3.97 hectares per household.
18. Approximately, 4.6 million coconut palms are currently growing in Bougainville, out of which 4.2 million are bearing, 0.2 million are immature and the remaining 0.05 million are senile.
19. Palm mortality during the crisis period was estimated to be 530,000, while 337,000 succumbed to the drought of 1996 and 1997.
20. Total number of trees would have been over 5.5 million, had there been no losses due to the crisis and drought, with an average density of 169 trees per hectare.
21. Five out of every six-coconut growers had inter-planted with cocoa, while only (14.2%) coconut sole-planted. No growers inter-planted with other crops.
22. Nearly three-fourth of the coconut growers have a plan to extend their coconut blocks by planting an estimated total of 0.8 million trees. To calculate the number of block(s) growers wanted to extend, simply divide the above number by the estimated number of coconut trees per hectare.
23. An estimated total of 850,000 trees were new-planted by (6.3%) of the total coconut growers, while 1.0 million trees were re-planted by (14.2%) of the growers.
24. (13.7%) of the total labour assistance come from outside family members i.e. from hired labour. Producers spent an average of K15 per fortnight on hired labour. However, this provincial average varied considerably from district to district ranging from K14 to K48.
25. (40.2%) of the growers wanted to replace their old coconut trees. Of these (43.1%) wanted to do it within 6 months while (19.6%) wanted within 3 months and the rest wanted within a year.

26. Nearly sixty per cent of the coconut growers claimed to source most of their coconut seed nuts from their own nurseries while over one-fourth of the growers claimed CCRI/DPI as their source of seed nuts and (11.8%) said they obtained seed nuts from community nurseries.
27. Over two-thirds of the growers (70.1%) used triangular method for planting coconut, while simple row method of spacing was the next most popular (29.9%) amongst the growers. Only a fraction of the growers indicated other method of spacing used for planting.
28. One-third of growers claimed their trees were being damaged by insects and diseases the coconut. Nearly half of them stated leaves as the major parts of the trees damaged by insects and diseases. Shoots were the next affected (25.0%), followed by leaves/roots and trunk (8.3%).
29. Only (14.2%) of the growers reported that their coconut seedlings were damaged by insects and diseases. However, over fifty per cent of them mentioned that leaves/roots were the major parts of the trees damaged by the insects and diseases, while (44.4%) mentioned leaves only as the affected parts.
30. Over ninety per cent of the growers intended to clean their coconut blocks, of which (48.3%) reported that they would clean within three months while a little over one-fourth of the growers intended to clean within six months. Only (10.8%) mentioned within a year.
31. Over two-third (66.9%) of the growers mentioned that they had appropriate tools while one-third mentioned they did not
32. Nearly half of the copra growers owned dryers. Out of these, (85.0%) stated owning "smoke" type while (15.0%) claimed to own "Hot Air" type.
33. Half of the coconut growers had producer's number.
34. Over three-fourth of the growers reported that their dryers were in working conditions. However, those who reported their dryers not being in working conditions provided various reasons; 'broken pipes and bed' were the major causes among them. While nearly one-fourth stated the dryers were beyond repairs and (15.4%) reported the dryers needed major repairs.

COCOA AND COCONUT BASELINE SURVEY BOUGAINVILLE

INTRODUCTION

The survey project was designed to collect baseline data on the current situation of smallholder cocoa and coconut plantations on Bougainville. The project was a component of the Bougainville Rehabilitation Programme, funded by the Stabex (EEC). Within the component, the present study deals with the collection of key baseline data on cocoa and coconut standing trees, area and condition of gardens, trees damaged due to crisis, drought, and insects/diseases, trees new or replanted, hired labour etc. which would be useful to plan major cocoa and coconut rehabilitation on Bougainville.

The project was managed and implemented by the PNG Cocoa and Cocoa Extension Agency (PNG CCEA) with a close cooperation from the Division of the Primary Industries (DPI) Department of Bougainville.

The project was originally intended to be completed and the results published by early January 1999. The data collection was, however, delayed to the second week of February due to administrative problems and was commenced on the 16th of February 1999 through to 28th April 1999. Data collection took longer than anticipated, because of the current situation on Bougainville, which was compounded by the poor conditions of the road network with an acute shortage of transport availability and other technical problems on the mainland.

BACKGROUND

Cocoa and copra have been the dominant cash earners for 154,000 people on Bougainville. Coconuts were most likely introduced as a cash crop on Bougainville by the Germans prior to WW1. Minimal interest for its development as a cash crop was shown until the very late fifties and into early sixties. Cocoa was introduced by the Australians in the fifties as an alternative for the rice, corn and peanuts which were the main crops being grown at the time especially in South Bougainville. This was basically to protect Australian markets for these crops. Since then cocoa has been the dominant cash crop on mainland Bougainville. In 1989, production of cocoa reached 18,400 metric tonnes, of which about eighty per cent was produced by the smallholder sector. In the same year, over 27,000 metric tonnes of copra was produced. However, due to crisis there was sharp decline in production after 1990. Production fell to only 3,400 metric tonnes of cocoa and

12,000 metric tonnes of copra in 1996. This decline was mainly due to the majority of growers, moving away to Care Centres and other places for shelter during the crisis.

After 1997, when the Burnham talks commenced, many of the smallholder growers returned home and recommenced cocoa and copra production for their livelihood. Total cocoa production in 1998 was 21, 827 tonnes valued at K9, 173,902. Production in 1999 easily exceeded 1998 production levels with 16,895 tonnes valued at K..... In 1998 14,558 tonnes of copra were produced with a value of K7, 613,834

The participation of growers in income generation activities would make a significant contribution to the improvement of peace on Bougainville. Therefore, support for cocoa and coconut rehabilitation is encouraged, as it will have immediate benefits to increase disposable income for families as well as assisting in the restoration of peace on Bougainville.

The government of Papua New Guinea is fully committed to support peace initiatives and social and economic recovery on Bougainville. As part of the government commitment to the rehabilitation programme, a large-scale cocoa and coconut redevelopment and replanting campaign on the smallholder sector has already commenced. In order to formulate the service delivery plan of this programme and to monitor the progress, the planners and policy-makers need basic data on the current situation of smallholder cocoa and coconut plantations on Bougainville. There is dearth of data regarding tree numbers, their age, area and condition of cocoa and coconut blocks, new and replanting, redeveloping, processing and marketing and other related issues. As such information is necessary for programme planning it was decided that a baseline survey with the following objectives was required.

OBJECTIVES

The main objectives of the cocoa and coconut baseline survey were:

1. To estimate the population of standing cocoa and coconut trees, their age and condition of block(s) etc. on Bougainville.
2. To determine number of trees damaged due to the 9 years crisis and drought
3. To determine number of trees newly-planted or replanted in the last 12 months and future plan to extend cocoa and coconut block(s).

4. To provide information on labour assistance and unit cost paid by growers, source of seedlings, spacing used on planting, fermentary, cleaning, pruning and tools etc.
5. To estimate number of cocoa and coconut growing households to be rehabilitated and thus work out planting material requirements.
6. To work-out the extent to which financial and manpower resources would be required based on the survey results.
7. To establish a suitable reference point for subsequent data collection activities.

SAMPLE DESIGN

The Bougainville cocoa and coconut baseline survey required a representative sample of cocoa and coconut growers to meet the survey objectives. For ease of conducting the survey, households were considered as the ultimate sampling units. Households involved in cocoa and coconut production activities on Bougainville were considered eligible for interview in the survey. There are eleven districts in Bougainville, which were used to draw the sample.

The cocoa and coconut baseline survey adopted a two-stage sample design. The first stage was the selection of villages from each district, called Primary Sampling Units (PSU), while in the second stage households were chosen from the selected PSU.

In the first stage, the selection of villages were done with a probability proportional to estimated size (PPES), size being the number of households on the Bougainville Electoral Rolls in each respective village. In the planning stage, it was initially decided that at least 50% of total villages in the province would be selected for interview. However, due to some administrative problems such as; shortage of enumerator, funding and off course a bit of risks exist in some of the areas due to the crisis, the coverage of the study was reduced to 13% only i.e. the survey was carried out in 74 villages. This procedure of selection of sample was thought to be most appropriate for this study where values of the variables were unknown.

In the second stage of sampling, cocoa and coconut growing households were randomly chosen from the selected villages. In order to get required representation, 7 per cent of the total households from each selected village were chosen for interview.

Distribution of villages and households by district can be seen on the next page:

DISTRIBUTION OF VILAGES AND HOUSEHOLDS BY DISTRICTS

DISTRICT	Total Villages	Village Selected	Total Households in selected village	Household Selected
Buka	45	06	441	31
Buin	107	14	620	41
Kieta	78	10	415	28
Torokina	45	06	127	08
Kunua	47	07	234	16
Siwai	74	10	598	41
Bana	32	04	343	23
Selau	39	05	211	15
Tinputs	28	04	198	14
Wakunai	48	05	211	13
Nissan	17	02	030	02
Total	560	73	3428	232

QUESTIONNAIRE

Before preparing the first draft of the questionnaire, statisticians had several rounds of discussions with the Executive Director (PNG CCEA), National Extension Manager (PNG CCEA), Regional Extension Manager (PNGCCEA-NGI), Assistant Secretary, Division of Primary Industry (DPI), Bougainville and Provincial Extension Manager – Bougainville, on survey topic and designing of questionnaire. Discussions were also held on the entire statistical operations of the study. It was felt that, some questions on other economic activities such as subsistence farming, livestock and marketing aspects etc. should also be added.

A draft questionnaire was then designed in consultation with them and was further reviewed by the committee before sending out for pre-testing in various locations of Bougainville and Madang. Statistician from PNG CCEA, Madang conducted the pre-testing with the assistance of Assistant Secretary, DPI Buka and Regional Extension Manager – NGI and Provincial Extension Manager - Bougainville. Enumerators were engaged to carry out the pre-testing.

The objective of the pre-testing was:

1. To determine the relevance of the questions asked.
2. To test the language of the questionnaire to ensure that the question conveyed the meaning that was intended.
3. To determine whether there was a logical flow from one question to another.
4. To find out the duration of the interview in order to estimate the number of enumerators that would be needed for survey.
5. To test the format of the questionnaire such as; which question should be close-ended and which ones be open-ended.

The pre-testing revealed that certain questions were irrelevant and certain others were too complicated for the growers. After necessary modification, the questionnaire was further reviewed and finalised.

ENUMERATORS

The interview teams consisted of generally 4 members, one extension officer and three grade 10 school leavers drawn from the proximate villages. District DPI officers were engaged as supervisors for their respective districts. They were given a thorough training for 3 days in Buka to familiarize them with the questionnaire and to sharpen their skills in interview work. The training covered the following aspects:

1. The purpose of the study.
2. Technique of data collection.
3. Discussion on how the enumerator should conduct themselves.
4. Discussion on each item of the questionnaire.
5. Field practice using actual questionnaire.

During the training session, District DPI Officers were called to attend the training.

On each survey day, each team including the supervisors went to the selected villages and briefly explained the purpose of the visit to the village people. However, no advance information was

given to the selected households about data collection. This was done to minimise sensitisation of the growers. Our experience shows that if the respondents know the purpose of the visit, they tend to provide "desired response, which might increase more non-sampling errors.

QUALITY CONTROL

Quality of data collected in this survey was checked at different phases. Throughout the field work, District DPI officers who were engaged as supervisors remained in the field with their respective teams to ensure correct completion of enumeration by the enumerators. Supervisors also randomly did some spot-checking of questionnaire so that error could be amended before leaving the area. PNG CCEA Statistician had been in Buka throughout the training and data collection period to check quality of field work and solve problems as they arose.

After the completed questionnaire returned to the DPI Office, Bougainville, questionnaires were edited to detect irregularities. The field work was also reviewed in some cases when non-response rate was high.

After editing the questionnaires, the data were transferred into the coding sheets which were designed earlier. Data were transferred to the coding sheets with the help of a comprehensive coding guide, prepared on the basis of response to roughly about ten per cent interviews. The coding guide included question number, code categories and code numbering. Coding was done by the PNG CCEA statistician. Cross-checking of the coding was done before analysis.

ANALYSIS

Considering the size of the sample and the deadline for submitting the report, it was felt that data processing could be best done by using a computer. However, on checking the computer facilities available one did not feel encouraged to go for computer analysis. In addition, recruitment of a programmer/systems analyst to design a computer program for analysing survey data was not feasible due to funding problem. Consequently, it was decided that the data be analysed manually. The nature of this study did not call for the use of any sophisticated statistical techniques. Only simple classification, tabulation and calculation of percentages were required for the analysis.

GROWERS CHARACTERISTICS

TABLE 1- SAMPLE CHARACTERISTICS (PERCENTAGE)

HOUSEHOLD DETAILS	BUKA (n = 31)	BUIN (n = 31)	KIETA (n = 28)	TOROKINA (n = 8)	KUNUA (n = 16)	SIWAI (n = 41)	BANA (n = 14)	SELAU (n = 14)	TINPUTZ (n = 15)	WAKUNAI (n = 23)	NISSAN (n = 23)	TOTAL (n = 232)
AGE GROUP												
1 - 25 Years	6.5	0.0	0.0	0.0	0.0	4.9	0.0	0.0	0.0	8.7	0.0	2.6
26 - 34 Years	3.2	14.6	25.0	25.0	31.3	22.0	7.7	21.4	20.0	39.1	50.0	20.3
35 - 44 Years	22.6	29.3	28.6	50.0	37.5	26.8	23.1	57.1	40.0	17.4	0.0	29.7
45 - 55 Years	48.4	17.1	32.1	25.0	18.8	14.6	46.2	14.3	26.7	34.8	50.0	27.2
55 and Over	19.4	39.0	14.3	0.0	12.5	31.7	23.1	7.1	13.3	0.0	0.0	20.3
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
EDUCATION												
No Education	3.2	4.9	3.6	0.0	25.0	2.4	0.0	0.0	0.0	0.0	0.0	3.9
Primary Level	58.1	82.9	78.6	0.0	50.0	75.6	92.3	78.6	86.7	78.3	100.0	72.8
Secondary Level	35.5	12.2	14.3	37.5	25.0	22.0	7.7	21.4	13.3	21.7	0.0	20.3
Others	3.2	0.0	3.6	62.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
OCCUPATION - PRIMARY												
Cocoa - Grower	29.0	85.4	57.1	62.5	25.0	80.5	100.0	35.7	66.7	91.3	100.0	65.9
Copra - Grower	58.1	2.4	42.9	37.5	75.0	19.5	0.0	50.0	33.3	8.7	0.0	29.3
Subs. Farmer	0.0	7.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3
Trade Store	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Labourer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3	0.0	0.0	0.0	0.9
Others	12.9	4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
FAMILY SIZE												
0 - 1	3.2	2.4	3.6	0.0	0.0	0.0	0.0	0.0	0.0	21.7	0.0	3.4
2 - 3	3.2	7.3	25.0	12.5	12.5	14.6	23.1	7.1	26.7	13.0	0.0	13.4
4 - 5	9.7	43.9	17.9	25.0	31.3	39.0	15.4	21.4	13.3	26.1	50.0	27.2
6 - 7	35.5	24.4	32.1	37.5	12.5	22.0	30.8	28.6	40.0	17.4	0.0	26.7
8 - 9	32.3	22.0	21.4	25.0	43.8	22.0	30.8	42.9	20.0	21.7	50.0	26.7
10 and Over	16.1	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	2.6
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

During the discussion with the authorities, it was suggested that all the districts on Bougainville should be covered in the scope of the study. Table 1 represents district-wise grower characteristics. Growers were questioned about their age, formal education, primary and secondary occupation and family size. Table 1 also indicates that the majority of growers (29.7%) were within the age group of 35 – 44 years with (97.4%) of growers being in the age group of 26 and above. Only (2.6%) of growers in Bougainville were under 25 years of age. This scenario very much coincides with Wilson and Evans, as they found only (2-3%) of growers in the same province were under 25 years of age. Table 1 also shows that there is no variation in the age group across the district.

Of the total 232 growers interviewed, all of them had formal education except 9 growers, that is, (3.9%) who have had no formal education. Seventy-two per cent of them had primary education while nearly one-fourth of the growers had a secondary education. Only (3.0%) reported that they had other types of education such as vocational etc. Table 1 also indicates that majority of the growers in each district had obtained at least primary education with the exception of Torokina district, maximum growers of which had other level of education along with secondary education.

Cocoa and coconut cultivation were the primary occupation of most of the households. Nearly three-fourth of the growers were involved in cocoa growing activities while over one-third of the growers were involved in coconut growing activities. Only a minority were involved with some other crops. Table 1 also shows that majority of the growers in the mainland districts were monthly growing cocoa.

Distribution of growers according to their family size can also be seen in Table 1. Over eighty per cent of the growers living in any area of Bougainville had more than 3 members while (13.4%) had 2 to 3 members and single family or family with one member accounted for only (3.4%).

The average household size in Bougainville was estimated to be 5.2 persons, as compared to the national average of 6 person per household.

ESTIMATION OF POPULATION TOTAL

Suppose the population consists of N first-stage units (PSU) and the i -th PSU contains M_i second-stage units (SSU), $i = 1, 2, 3, \dots, N$. To make the discussion concrete, we shall suppose that the PSU are villages and that the SSU are households. The total number of households in the population is M_i and this is usually unknown. Let us denote the value of the study variable for the j -th household in the i -th village. The total of all such values for the i -th village is:

$$Y_i = \sum_{j=1}^{M_i} y_{ij} = M_i \bar{y}_i \quad \text{say}$$

Where $\bar{y}_i = Y_i/M_i$ is the mean per household for the i -th village. The grand total of all y -values in the population is:

$$Y = \sum_{i=1}^N Y_i = \sum_{i=1}^N M_i \bar{y}_i$$

The mean per village is: $\bar{Y} = Y/N = \sum_{i=1}^N M_i \bar{y}_i / N$ and

The mean per households is: $\bar{y} = Y / \sum_{i=1}^N M_i = \sum_{i=1}^N M_i \bar{y}_i / \sum_{i=1}^N M_i$

Example:

Suppose n villages are selected by srswr from the population of N village, and that out of the M_i households in the i -th selected village m_i are chosen in the second stage, again by srswr ($i = 1, 2, 3, \dots, n$). Let y_{ij} denote the value of the study variable for the j -th selected household ($j = 1, 2, 3, \dots, m_i$) in the i -th selected village.

Here, consider the i -th sample village. This village has M_i households and m_i of them have been selected and covered for the data collection. From the theory of srswr, we find that the sample mean \bar{y}_i defined as:

$$\bar{y}_i = 1/m_i \sum_{j=1}^{m_i} y_{ij}$$

is an unbiased estimator of the mean \bar{Y}_i for this village. Also, M_i times \bar{y}_i is an unbiased estimator of the total Y_i for the village. In symbols, the estimator of the total Y_i is:

$$\hat{Y}_i = M_i \bar{y}_i = M_i / m_i \sum_{j=1}^{m_i} y_{ij}$$

Such estimators can be formed separately for all the n sample villages.

COCOA HOUSEHOLD, CURRENT TREES, AREAS AND TREES DAMAGED DUE TO CRISIS AND DROUGHT.

Table 2 represents the number of households growing cocoa on Bougainville, area of cocoa block(s), current standing cocoa trees and trees damaged due to 9 years conflict and drought on Bougainville. The results are estimates based on a moderate sample size, they do, however, indicate the current status of cocoa and coconut plantations on Bougainville.

There was an estimated total of 15,715 households in the province, cultivating a total area of 47,774 hectares of cocoa blocks, both sole and inter-planted with coconut, thus giving an average of 3.04 hectares per households. This rate is much higher than the rate obtained by the North Solomon Provincial Crop Survey in 1982/83 (1.43 hectares per household).

TABLE 2- COCOA : NUMBER OF HOUSEHOLDS (H/H), AREAS, STANDING TREES AND TREES DAMAGED DUE TO 9 YEARS CRISIS AND DROUGHT

DISTRICT	NO. OF H/H	AREA (HA) OF BLOCKS	COCOA PLANTING CLASSIFICATIONS				TREES DAMAGED DUE TO CRISIS	TREES DAMAGED DUE TO DROUGHT
			BEARING	IMMATURE	SENILE	TOTAL		
BUKA	1,075	5,790.72	762,588	72,273	76,449	911,311	424,749	692,466
BDIN	2,780	4,993.29	857,459	261,717	464,463	1,293,039	2,831,396	1,125,368
KIETA	1,072	2,680.64	553,924	132,328	106,787	795,038	1,212,046	195,187
TOROKINA	704	4,295.00	1,111,880	127,600	145,904	1,385,384	194,289	194,751
KUNUA	1,056	3,650.28	129,554	85,103	62,104	276,762	615,628	199,607
SIWAI	2,537	5,792.30	1,207,035	401,960	6,807	1,615,821	1,453,825	650,789
BANA	1,787	5,360.50	266,120	199,119	23,094	488,538	1,376,952	608,135
SELAU	1,096	3,688.43	525,141	96,021	9,238	633,410	2,562,761	614,451
TINPUTZ	1,478	7,556.94	1,783,453	87,498	1,164,073	3,035,024	1,822,753	139,940
WAKUNAI	1,819	6,505.15	1,678,967	641,632	43,972	2,363,672	2,947,571	868,808
NISSAN	312	576.08	224,640	164,324	102,272	492,336	19,968	40,416
B'VILLE	15,716	50,909.33	8,809,887	2,272,285	2,208,163	13,290,335	14,371,929	4,530,320

Tinputz district had 7,556 hectares of land (14.8%) either sole or inter-planted with coconut, the highest in the province, followed by Wakunai 6,505 hectares (12.7%), Buka 5,790 hectares and Siwai districts 5,378.72 hectares (11.3%). The average area under cocoa blocks per household from these districts were: Torokina 6.1 hectares per household, Buka 5.3 hectares, Tinputz 5.1 hectares and Wakunai 3.5 hectares per household. Kunua district had 3.4 hectares per household.

Table 2 also indicates that, an estimated total of 13.3 million cocoa trees were standing on Bougainville, out of which, 8.8 million trees (66.1%) were bearing, 2.3 million (17.2%) were immature and 2.2 million trees (16.5%) were senile. Tinputz district, had 3.1 millions of cocoa trees, approximately one-fourth of the total number of standing cocoa trees in the province, followed by Wakunai with 2.4 million trees (18.0%), Siwai with 1.6 million (12.0%) and Torokina with 1.4 million (10.5%) trees.

Further analysis indicated that, out of 3.1 million cocoa trees in Tinputz district, 1.8 million (58.1%) were bearing, 0.9 million (29.0%) were immature and 1.3 million trees (41.9%) were senile. Similarly, Wakunai district had 1.7 million bearing trees, i.e. (71.0%) while 0.6 million trees (27.1) were immature and 0.04 million were senile (1.9%). Siwai had 1.2 million bearing trees (74.7%), 0.4 million immature (24.9%) and 0.06 million trees (0.4%) senile.

Trees damaged due to nine years crisis on Bougainville was estimated to be 14.4 million, which is about ten percent higher than the current trees standing. However, Wakunai was the most affected district due to crisis; lost 2.9 million trees, i.e (20.1%) of the total trees damaged during the crisis. Buin was the next, as 2.8 million (19.4%) trees were destroyed, followed by Selau (18.0%), Siwai (10.2%), Bana (9.7%) and Kieta (8.5%) districts. The less affected district was Nissan, as only 0.02 million trees were damaged.

A large number of cocoa trees were also affected by the 1996 and 1997 drought in PNG. There was an estimated total of 5.5 million cocoa trees destroyed, out of which 1.1 million (20.%) were from the Buin district while Wakunai had 0.9 million trees(16.3%), when Buka, Siwai, Bana and Selau districts had about (13.0%) or 0.6 million trees destroyed in each respectively.

The total number of standing cocoa trees would have been over 33.2 million on Bougainville with an average of 694 cocoa trees per hectare had there been no damages due to the crisis and the drought in 1996 and 1997.

COCONUT HOUSEHOLDS, CURRENT TREES, AREAS AND TREES DAMAGED DUE TO CRISIS AND DROUGHT.

Coconut did not seem to be as popular as cocoa (Table 3). This may be because of the high altitude in most of the mainland where probably the environment is conducive to cocoa production. Approximately 8,151 households were involved in either sole-coconut or inter-planted with cocoa, covering a total area of 32,382 hectares of land. This gave an estimated average of 3.97 hectares per household under coconut blocks in Bougainville.

Buka had 5,189 hectares of land (19.1%) of the total area under coconut blocks, the highest area in Bougainville, followed by Tinputs with 5,946 hectares, Torokina with 5,010 hectares and Kunua district with 3,645 hectares of land. The area under coconut blocks per households of these districts are respectively: Buka (5.7 hectares per household), Tinputs (5.1 hectares per household), Torokina (14.2 hectares per household) and Kunua (3.9 hectares per household).

TABLE 3 - COCONUT : NO. OF HOUSEHOLDS, AREAS, STANDING TREES AND TREES DAMAGED DUE TO 9 YEARS CRISIS AND DROUGHT

DISTRICTS	NO. OF H/H	AREA (HA) OF BLOCKS	COCONUT PLANTING CLASSIFICATIONS				TREES DAMAGED DUE TO CRISIS	TREES DAMAGED DUE TO DROUGHT
			BEARING	IMMATURE	SENILE	TOTAL		
BUKA	1,081	6,189.45	872,295	24,575	1,622	898,491	60,860	13,440
BUIN	476	730.32	108,052	13,600	20,400	142,052	3,264	2,924
KIETA	688	1,626.36	208,579	9,517	1,873	219,969	105,340	8,332
TOROKINA	352	5,009.84	708,400	53,768	8,008	770,176	231,000	231,000
KUNUA	925	3,645.16	557,577	39,313	5,484	602,373	3,304	24,975
SIWAI	741	1,645.64	296,462	18,587	2,779	317,827	12,659	6,793
BANA	688	3,378.08	92,192	68,800	4,128	165,120	15,136	35,776
SELAU	1,016	3,369.21	386,705	43,375	1,094	431,175	22,508	23,055
TINPUTS	1,162	5,945.86	292,556	19,575	1,698	313,829	35,754	83,306
WAKUNAI	711	274.13	386,231	24,885	1,896	413,012	4,029	316
NISSAN	311	478.94	21,770	7,153	1,866	30,789	4,976	1,555
BOUGAINVILLE	8,151	32,381.93	4,265,733	274,246	45,697	4,585,676	529,751	336,822

Table 3 also reveals that an estimated total of 4.6 million coconut trees were currently growing in Bougainville, out of which 4.2 million trees i.e. (91.3%) were bearing, 0.3 million ((6.5%) were immature and 0.05 million (1.0%) were senile. Buka district had 0.9 million coconut trees (19.5%), the highest on Bougainville while Torokina district was the next 0.8 million trees (17.3%), followed by Kunua 0.6 million (13.0%), Selau and Wakunai districts, each had 0.4 million coconut trees (8.6%).

The number of palm trees lost during the nine years crisis on Bougainville was estimated to be over 0.5 million. Torokina was the most affected district as over 0.2 million (231,000) of coconut trees, the highest number, i.e. (40.0%) of the total damaged, followed by Kieta with 0.1 million trees (20.09%) and Buka with 0.06 million trees (12.0%) .

The 1996 and 1997 drought in PNG also destroyed coconut trees on Bougainville as Table 3 indicates. It is estimated that a total of 0.3 million (336,822) coconut trees were destroyed by the drought. Torokina, the worst affected area, lost approximately 0.23 million coconut

trees by drought. Tinputz lost 0.08 million trees (26.6%), followed by Bana 0.04 million (13.3%) and Kunua 0.02 million trees (6.8%).

The total number of coconut trees would have been over 5.5 million, had there been no destruction from the crisis and the drought.

COCOA : DESCRIPTION OF PLANTINGS

An attempt was made to determine the description of planting types on Bougainville. The word "Type" is defined as to whether cocoa was sole-planted or inter-planted with other crops. When this was asked, Table 4 indicates, that over forty per cent of the cocoa growers reported that they had cocoa sole-planted while (57.2%) inter-planted with coconut and the rest inter-planted with other crops.

We were also interested to find out if there was any significant variation in the type of planting from district to district. The value of Chi-Square was highly significant at 20 degrees of freedom, which means that there was a significant variation in the percentage of cocoa sole-planted and inter-planted with coconut and other crops.

TABLE 4 – COCOA: DESCRIPTION OF PLANTINGS (PERCENTAGE)

District	Sole-planted	Inter-planted with coconut	Inter-planted with other Crops
Buka	3.8	96.2	0.0
Buin	80.5	19.5	0.0
Kieta	52.0	48.0	0.0
Torokina	75.0	25.0	0.0
Kunua	13.3	86.7	0.0
Siwai	53.7	29.3	17.0
Bana	76.9	23.1	0.0
Selau	7.1	92.9	0.0
Tinputs	26.7	73.3	0.0
Wakunai	65.2	34.8	0.0
Nissan	0.0	100.0	0.0
Bougainville	41.3	57.2	1.6

$$X^2 = 105.74, 20 \text{ d.f.}$$

Table 4 also shows that, while the vast majority of the households of Buka, Selau, Nissan Kunua and Tinputa districts inter-planted with coconut, Buin, Kieta, Torokina, Siwai, Bana and Wakunai districts favoured sole-planting. Siwai was the only district which inter-planted cocoa with other crops.

COCONUT : DESCRIPTION OF PLANTINGS

A similar approach was used to define coconut-planting types in Bougainville. Table 5 indicates that, 5 out of every 6 coconut growing households in Bougainville inter-planted with cocoa while only (14.2%) sole-planted. Surprisingly, no coconut grower inter-planted with other crops apart from cocoa.

TABLE 5 – COCONUT: DESCRIPTION OF PLANTINGS

District planted	Sole-planted	Inter-planted	Inter-
		With cocoa	with other crops
Buka	16.7	83.3	0.0
Buin	28.6	71.4	0.0
Kieta	11.1	88.9	0.0
Torokina	50.0	50.0	0.0
Kunua	28.6	71.4	0.0
Siwai	16.7	83.3	0.0
Bana	0.0	100.0	0.0
Selau	0.0	100.0	0.0
Tinputa	0.0	100.0	0.0
Wakunai	11.1	88.9	0.0
Nissan	0.0	100.0	0.0
Bougainville	14.2	85.8	0.0

$$X^2 = 13.66, 20 \text{ d.f.}$$

Table 5 also indicates that all the growers in Bana, Selau, Tinputa and Nissan districts had inter-planted with cocoa while growers from others districts had coconut sole-planted. This represents a range of (11.1 %) to (50.0%). Further analysis showed that there was no significant difference observed in the type of planting among the districts as the value of chi-square is smaller than the tabulated value at 5% level of significance.

FUTURE PLAN TO EXTEND COCOA BLOCK(S)

Do you have any plans to extend cocoa block(s)? When this question was put to the cocoa growers, nearly sixty per cent of them replied that they had planned to extend their cocoa block(s). Those planning such an extension were further asked - how many block(s) did they want to extend? They indicated that they had a planned to extend cocoa block(s) by planting an estimated total of 13.7 million cocoa trees. To calculate the number of block(s) growers wanted to extend, simply divide this figure by the estimated number of cocoa tree per block. Analysis by district revealed that, growers from Bana district have the biggest plans regarding extension of their cocoa block(s), by planting an estimated total of 4.1 million trees i.e. (30.1%) followed by Tinputs, Torokina and Siwai districts which had 2.5 million (18.1%), 1.8 million (12.8%) and 1.5 million (10.7%) of the trees respectively.

TABLE 6 - COCOA: FUTURE PLAN TO EXTEND COCOA BLOCK(S)

District	-----Plan to extend cocoa block(s)-----		Number of Trees
	Yes	No	
Buka	3.8	96.2	997,269
Buin	73.2	26.8	1,084,878
Kieta	52.0	48.0	999,962
Torokina	87.5	12.5	1,760,000
Kunua	73.3	26.7	746,237
Siwai	68.3	31.7	1,462,797
Bana	61.5	38.5	4,130,719
Selau	71.4	28.6	628,634
Tinputs	73.3	26.7	2,483,040
Wakunai	52.2	47.8	1,025,362
Nissan	100.0	00.0	21,056
Bougainville	59.6	40.4	13,721,450

$$X^2 = 46.26, 10 \text{ d.f.}$$

An attempt was made to determine whether there was a significant difference between districts in the percentage of growers planning to extend their cocoa blocks. We applied the Chi-Square test and found a significant difference between the districts. This may be because a large number of cocoa trees were destroyed during the drought and crisis periods. However, growers from Buka district have little plan to extend block(s) probably reflecting a lesser impact on tree population in that district as a result of the crisis and/or drought.

FUTURE PLAN TO EXTEND COCONUT BLOCK(S)

In the case of coconut, an opposite scenario can be seen in Table 7, as nearly three-quarters of the coconut growing households from all the districts mentioned that they did not have any plans to extend their coconut block(s). However, when those households who did were asked, "how many coconut block(s) did they want to plant". Their combined responses indicated that the provincial total would be extended by an estimated total of 0.8 million-coconut trees. To work out the area of coconut block(s) growers wanted to extend in future simply divide this figure by the estimated number of coconut trees per hectare. On a district basis, respondents in Kieta indicated intentions to plant an estimate of 0.3 million (38.6%) trees. This is the largest district level expansion of coconut planting in the province, followed by Selau 0.2 million (27.8%) trees, Buka 0.1 million (14.1%) trees and Tinputa 0.08 million (9.7%) trees.

**TABLE 7 – COCONUT: FUTURE PLAN TO EXTEND COCONUT BLOCK(S)
(PERCENTAGE)**

District	-----Plan to extend cocoa block(s)-----		Number of Trees
	Yes	No	
Buka	23.3	76.7	117,469
Buin	42.9	57.1	35,088
Kieta	22.2	77.8	321,067
Torokina	25.0	75.0	17,600
Kunua	21.4	78.6	26,429
Siwai	33.3	66.7	15,746
Bana	20.0	80.0	27,520
Selau	53.8	46.2	180,770
Tinputa	15.4	84.6	80,446
Wakunai	11.1	88.9	2,370
Nissan	50.0	50.0	7,464
Bougainville	26.8	73.2	831,968

$$X^2 = 9.28, 10 \text{ d.f.}$$

We also applied the chi-square test to determine whether there was any significant difference in the percentage of planned expansion of coconut block(s). The value of chi-square indicated that there was no significant difference.

COCOA TREES NEW OR REPLANTED IN THE LAST 12 MONTHS

TABLE 8 -- COCOA : NUMBER OF TREES NEW OR RE-PLANTED AND TYPES IN THE LAST 12 MONTHS (PERCENTAGE)

DISTRICT	COCOA											
	NEW PLANTED					NO. OF TREES NEW PLANTED	RE-PLANTED			TYPES		NO. OF TREES RE-PLANTED
	YES	NO	VILLAGE	HYBRID	BOTH		YES	NO	VILLAGE	HYBRID	BOTH	
BUKA	15.4	84.6	25.0	75.0	0.0	187,783	30.8	69.2	12.5	87.5	0.0	543,662
BUIN	4.9	95.1	0.0	100.0	0.0	94,741	12.2	87.8	60.0	40.0	0.0	139,059
KIETA	24.0	76.0	83.3	16.7	0.0	170,765	32.0	68.0	100.0	0.0	0.0	220,220
TOROKINA	37.5	62.5	0.0	100.0	0.0	274,519	0.0	100.0	0.0	0.0	0.0	-
KUNUA	20.0	80.0	33.3	66.7	0.0	139,040	6.7	93.3	100.0	0.0	0.0	37,920
SIWAI	29.3	70.7	0.0	100.0	0.0	265,883	29.3	70.7	8.3	91.7	0.0	350,483
BANA	15.4	84.6	0.0	50.0	50.0	59,569	23.1	76.9	33.3	66.7	0.0	900,985
SELAU	42.9	57.1	66.7	33.3	0.0	139,636	71.4	28.6	50.0	50.0	0.0	1,002,875
TINPUTS	26.7	73.3	0.0	100.0	0.0	114,514	40.0	60.0	50.0	50.0	0.0	67,534
WAKUNAI	26.1	73.9	33.3	66.7	0.0	301,982	69.6	30.4	31.3	68.8	0.0	517,803
NISSAN	50.0	50.0	100.0	0.0	0.0	38,416	0.0	100.0	0.0	0.0	0.0	-
B'VILLE	22.0	78.0	28.6	69.4	2.0	1,987,731	30.9	69.1	40.6	59.4	0.0	4,489,133

Table 8 indicates the number of trees planted in the last 12 months. It also presents a break down of planting type, that is whether they were new plantings or replants to replace trees lost within existing blocks. Less than one-fourth of the growers were engaged in new planting in the last 12 months while (30.9%) were engaged in replanting.

We asked those engaged in new or re-planting over the last 12 months to state the number and type of plantings. An estimated total of nearly 2.0 million cocoa trees were new plantings while well over 4.0 million trees were re-plantings. Wakunai district had the highest total number of trees new-planted in the last 12 months and had the highest number of trees new-planted. Nissan had the lowest. Selau district had the highest number of trees re-planted while Torokina had no new plantings.

Hybrid was the most popular type of planting material used as nearly seventy percent of cocoa growers specified that they used hybrid materials in new plantings and (59.4%) of the growers also used the same type in re-planting. A little over one quarter said that they used ordinary village type in new planting while (40.6%) mentioned that they also used the same type for re-planting. On a district basis, respondents in Buin, Torokina, Siwai and Nissan stated that they used hybrid type for new planting. Growers in Kieta and Kunua districts used the ordinary village type material for re-planting.

COCONUT TREES NEW OR REPLANTED IN THE LAST 12 MONTHS

TABLE 9 -- COCONUT : NUMBER OF TREES NEW OR RE-PLANTED IN THE LAST 12 MONTHS AND TYPES (PERCENTAGE)

DISTRICT	COCONUT											
	NEW PLANTED		TYPES			NO. OF TREES NEW PLANTED	REPLANTED		TYPES			NO. OF TREES RE-PLANTED
	YES	NO	VILLAGE	HYBRID	BOTH		YES	NO	VILLAGE	HYBRID	BOTH	
BUKA	13.3	86.7	100.0	0.0	0.0	551,310	13.3	86.7	100.0	0.0	0.0	94,047
BUIN	0.0	100.0	0.0	0.0	0.0	-	0.0	100.0	0.0	0.0	0.0	-
KIETA	0.0	100.0	0.0	0.0	0.0	-	0.0	100.0	0.0	0.0	0.0	-
TOROKINA	25.0	75.0	0.0	0.0	0.0	7,040	0.0	100.0	0.0	0.0	0.0	-
KUNUA	0.0	100.0	0.0	0.0	0.0	-	7.1	92.9	0.0	100.0	0.0	185,200
SIWAI	0.0	100.0	0.0	0.0	0.0	-	0.0	100.0	0.0	0.0	0.0	-
BANA	20.0	80.0	100.0	0.0	0.0	30,960	20.0	80.0	100.0	0.0	0.0	3,440
SELAU	15.4	84.6	50.0	0.0	0.0	257,048	53.8	46.2	85.7	0.0	14.3	416,560
TINPUTZ	0.0	100.0	0.0	0.0	0.0	-	7.7	92.3	100.0	0.0	0.0	61,586
WAKUNAI	0.0	100.0	0.0	0.0	0.0	-	33.3	66.7	100.0	0.0	0.0	238,185
NISSAN	0.0	100.0	0.0	0.0	0.0	-	50.0	50.0	100.0	0.0	0.0	7,775
B'VILLE	8.3	93.7	75.0	12.5	12.5	846,358	14.2	85.8	88.9	5.6	5.6	1,006,793

A small proportion of coconut growers indicated that they had done either new or re-planting in the last 12 months as can be seen in Table 9. However, when asked about the planting types, it was found that ordinary village type (generally indigenous tall) were the most popular choice. Three quarters of the growers said they used ordinary village type in new plantings while the vast majority (88.9%) said they also used the same type of materials in replanting.

Table 9 also indicates that an estimated total of 0.8 million-coconut trees were new-planted. On a district basis Buka had the highest number of palms new planted at 0.5 million, followed by Selau approximately 0.3 million, Bana 30,960 and Torokina 7,040 trees. Table 9 also shows that an estimated total of 1.0 million coconut trees were re-planted. Selau district re-planted a total of 0.4 million, (highest) while the lowest number of palms planted was in Bana District where only 3,440 trees were re-planted.

COCOA: LABOUR ASSISTANCE AND UNIT COST PAID PER FORTNIGHT

TABLE 10 -- COCOA: LABOUR ASSISTANCE AND UNIT COST (KINA) PER FORTNIGHT

DISTRICT	LABOUR ASSISTANCE		CATEGORIES			AV. UNIT COST (K) OF HIRED LABOUR PER FORTNIGHT
	YES (%)	NO (%)	FAMILY	HIRED LABOUR	TOTAL REQD.	
BUKA	100.0	0.0	13,194	977	14,171	29
BUIN	100.0	0.0	23,791	10,316	34,107	13
KIETA	100.0	0.0	15,478	3,901	19,379	11
TOROKINA	100.0	0.0	9,983	1,361	11,344	20
KUNUA	100.0	0.0	11,376	-	11,376	0
SIWAI	100.0	0.0	13,979	7,426	21,405	30
BANA	92.3	7.7	11,020	149	11,169	24
SELAU	100.0	0.0	6,296	1,856	8,152	20
TINPUTZ	100.0	0.0	7,865	315	8,180	10
WAKUNAI	100.0	0.0	5,950	3,424	9,374	50
NISSAN	100.0	0.0	3,430	-	3,430	10
BOUGAINVILLE	99.6	0.4	122,264	34,339	156,604	20

Paid labour was reported to be used by one-third of the cocoa growers on Bougainville. When hired labour was engaged, the average amount spent on paid labour was K20.00 per fortnight (Table 10). However, the amount spent on paid labour per fortnight varied considerably from one district to another as it ranged from K10.00 to K50.00 per fortnight across the districts. The standard deviation and covariance of the labour expenditure per grower per fortnight is 13.51 and 0.7% respectively.

Further analysis shows that, while the growers from Wakunai district spent an average of K50.00 per fortnight, Nissan, Tinputz, Kieta and Buin districts spent around K10.00 to K13.00 per fortnight. As expected growers with a large number of family members required minimum hired labour. Surprisingly, the situation in Bougainville confounded that trend. There was a negative relationship between large family and hired labour. The larger the family sizes the more labour that was required.

COCONUT: LABOUR ASSISTANCE AND UNIT COST PAID PER FORTNIGHT

**TABLE 11 – COCONUT : LABOUR ASSISTANCE AND UNIT COST (KINA)
PER FORTNIGHT**

DISTRICT	LABOUR ASSISTANCE		CATEGORIES			AV. UNIT COST (K) OF HIRED LABOUR PER FORTNIGHT
	YES (%)	NO (%)	FAMILY	HIRED LABOUR	TOTAL REQD.	
BUKA	100.0	0.0	196	35	231	20
BUIN	71.4	28.6	31	0	31	0
KIETA	100.0	0.0	76	36	112	27
TOROKINA	100.0	0.0	17	0	17	0
KUNUA	100.0	0.0	88	0	88	0
SIWAI	92.3	0.0	90	13	103	15
BANA	100.0	0.0	35	0	35	0
SELAU	100.0	0.0	80	30	110	48
TINPUTZ	100.0	0.0	80	0	80	0
WAKUNAI	100.0	0.0	50	6	56	40
NISSAN	100.0	0.0	10	0	10	0
BOUGAINVILLE	97.7	1.6	753	120	875	14

Labour hired from outside family for coconut cultivation in Bougainville seems to be slightly different from the situation with cocoa. Table 11 shows that, although individual coconut growers required almost hundred per cent labour supplementation i.e. most blocks required almost 2 labour unit (as it was with cocoa cultivation), they hired only (13.7%) of total labour from outside their families. The table also shows that growers from the districts of Buka, Kieta, Siwai and Selau also hired labour from outside their families.

Coconut growers spent an average of K14.00 per fortnight on paid labour. Average represents a range from K13.00 to K36.00 per fortnight. The standard deviation and covariance of the expenditure on hired labour per grower per fortnight was 17.92 and 1.6% respectively.

COCOA : GROWERS OPINION ON REPLACING OLD TREES

TABLE 12 -- COCOA : OPINION ON REPLACING OLD TREES

DISTRICT	GROWER'S OPINION		HOW SOON (%)				NO. OF TREES
	YES (%)	NO (%)	WITHIN 3 MONTHS	WITHIN 6 MONTHS	WITHIN 12 MONTHS	OTHERS	
BUKA	73.1	26.9	-	68.4	31.6	-	551,558
BUIN	92.7	7.3	65.8	26.3	7.9	-	2,415,549
KIETA	100.0	-	4.0	88.0	8.0	-	1,370,230
TOROKINA	100.0	-	12.5	75.0	12.5	-	1,370,230
KUNUA	93.3	6.7	35.7	57.1	7.1	-	715,853
SIWAI	97.6	2.4	37.5	40.0	17.5	5.0	1,721,447
BANA	92.3	7.7	25.0	50.0	25.0	-	5,380,245
SELAU	85.7	14.3	33.3	41.7	16.7	8.3	489,677
TINPUTS	93.3	6.7	21.4	42.9	35.7	-	2,381,157
WAKUNAI	82.6	17.4	10.5	15.8	31.6	42.1	634,277
NISSAN	100.0	-	50.0	50.0	-	-	39,936
BOUGAINVILLE	91.9	8.1	26.9	50.5	17.6	5.0	14,661,813

Respondents were asked if they wanted to replace any dead trees. Over ninety per cent of the cocoa growers replied that they wanted to replace dead trees. Growers were then asked to indicate how soon and the number of trees they wanted to replace. Half of the growers stated that they wanted to replace dead trees within six months. A little over one quarter indicated an intention to plant within three months while (17.6%) specified a time frame of one year.

We also sought to find out how many dead trees growers wanted to replace. When this was asked, it was found that an estimated total of 14.7 million dead trees would be replaced within 12 months. Responses from Bana district indicated a cumulative intention to replace 5.4 million dead trees (36.7%), the highest among the districts, followed by Buin district with 2.4 million planned replanting (16.5%). Tinputz with 2.3 million planned replanting (16.2%) and Siwai district 1.7 million trees planned replantings (11.7%).

COCONUT : OPINION ON REPLACEMENT OF OLD TREES

TABLE 13 -- COCONUT : OPINION ON REPLACING OLD TREES

DISTRICT	COCONUT						NO. OF OLD TREES
	GROWER'S OPINION		HOW SOON (%)				
	YES (%)	NO (%)	WITHIN 3 MONTHS	WITHIN 6 MONTHS	WITHIN 12 MONTHS	OTHERS	
BUKA	60.0	40.0	22.2	33.3	16.7	27.8	79,345
BUIN	28.6	71.4	50.0	0.0	0.0	50.0	693,600
KIETA	33.3	66.7	16.7	83.3	0.0	0.0	141,422
TOROKINA	25.0	75.0	0.0	100.0	0.0	0.0	88,000
KUNUA	35.7	64.3	0.0	80.0	20.0	0.0	87,214
SIWAI	33.3	66.7	25.0	50.0	25.0	0.0	96,021
BANA	40.0	60.0	50.0	0.0	50.0	0.0	249,744
SELAU	38.5	61.5	40.0	40.0	20.0	0.0	74,402
TINPUTZS	30.0	69.2	0.0	25.0	50.0	25.0	102,792
WAKUNAI	44.4	55.6	0.0	25.0	25.0	50.0	28,361
NISSAN	0.0	100.0	0.0	0.0	0.0	0.0	-
B'ILLE	40.2	59.8	19.6	43.1	19.6	17.6	1,556,584

Opinion on replacing dead coconut trees seemed to be different from cocoa, as only (40.2%) of the growers wanted to replace their old trees (Table 13). Out of these (43.1%) wanted to replace within six months while (19.6%) specified a three-month period and the rest wanted to do it within a year. Table 13 also indicates that, except in Nissan District, all the growers across the districts wanted to replace dead trees.

We asked those who wanted to replace dead coconut trees – how many old trees did they want replaced. Table 13 shows that, an estimated total of 1.6 million dead coconut trees would be replaced. Growers in Buin District reported that they wanted to replace 0.7 million trees, the highest number among the districts, followed by Bana, Kieta and Tinputs.

SOURCE OF COCOA SEEDLINGS

Respondents were asked where they would they obtain cocoa seedlings? It was encouraging to discover that the vast majority of the cocoa growers across the districts (84.8%) stated CCRI/DPI was their major source of cocoa seedlings, while (13.0%) sourced seedlings from their own nurseries and (1.3%) said that they used community nurseries. Only a fraction specified neighbours as their main source of cocoa seedlings (Table 14).

TABLE 14 – SOURCE OF COCOA SEEDLING (PERCENTAGE)

DISTRICTS	SOURCE OF SEEDLINGS					
	CCRI/DPI	N'BOURS	OWN NURSERY	COMM. NURSERY	OTHERS	TOTAL
BUKA	80.8	0.0	15.4	3.8	0.0	11.7
BUIN	70.7	0.0	29.3	0.0	0.0	18.4
KIETA	96.0	4.0	0.0	0.0	0.0	11.2
TOROKINA	100.0	0.0	0.0	0.0	0.0	3.6
KUNUA	100.0	0.0	0.0	0.0	0.0	6.7
SIWAI	100.0	0.0	0.0	0.0	0.0	18.4
BANA	84.6	0.0	15.4	0.0	0.0	5.8
SELAU	7.1	0.0	78.6	14.3	0.0	6.3
TINPUTS	100.0	0.0	0.0	0.0	0.0	6.7
WAKUNAI	95.7	4.3	0.0	0.0	0.0	10.3
NISSAN	100.0	0.0	0.0	0.0	0.0	0.9
BOUGAINVILLE	84.8	0.9	13.0	1.3	0.0	100.0

$$X^2 = 113.84, 30 \text{ D.F.}$$

SOURCE OF COCONUT SEED NUTS

Nearly sixty percentage of the coconut growers across the province reported that their own nursery was their major source of coconut seed nuts. A little over one quarter of the growers specified CCRI/DPI as their major sources of seed nuts while (11.8%) claimed Community Nurseries as their source (Table 15).

The chi-square value indicates that there was significant difference in the percentage of seedlings sources across the districts.

While the majority of growers from the districts of Torokina, Kunua, Nissan and Wakunai indicated CCRI/DPI as their major source of coconut seed nuts, Buka, Kieta, Siwai, Bana and Tinputts indicated a strong reliance on their own and private nurseries.

TABLE 15 — SOURCE OF COCONUT SEED NUTS (PERCENTAGE)

DISTRICTS	SOURCE OF SEEDLINGS					
	CCRI/DPI	N'BOURS	OWN NURSERY	COMM. NURSERY	OTHERS	TOTAL
BUKA	23.3	0.0	76.7	0.0	0.0	13.5
BUIN	28.6	28.6	14.3	28.6	0.0	5.5
KIETA	22.2	5.6	50.0	22.2	0.0	14.2
TOROKINA	50.0	0.0	0.0	50.0	0.0	3.1
KUNUA	42.9	0.0	14.3	42.9	0.0	11.0
SIWAI	33.3	0.0	58.3	8.3	0.0	9.4
BANA	20.0	0.0	80.0	0.0	0.0	3.9
SELAU	7.7	0.0	92.3	0.0	0.0	10.2
TINPUTS	7.7	0.0	92.3	0.0	0.0	10.2
WAKUNAI	44.4	0.0	55.6	0.0	0.0	7.1
NISSAN	50.0	50.0	0.0	0.0	0.0	1.6
BOUGAINVILLE	26.0	3.1	59.1	11.8	0.0	100.0

$$X^2 = 85.75, 30 \text{ d.f.}$$

COCOA : SPACING USED IN PLANTINGS

Triangular/Square spacing was the most popular method of cocoa planting on Bougainville, as indicated by almost 87 % of the growers across the districts, while (12.0%) used a simple row method. The remaining few indicated that they used various other types.

Simple rows planting arrangements were used by the majority of growers (71.4%). Further analysis revealed that there is a large variation from district to district in the percentage of spacing used in cocoa planting as the value of chi-square shows.

TABLE 16 COCOA : SPACING USED IN PLANTING (PERCENTAGE)

DISTRICTS	COCOA			
	TRIANGULAR SQUARE	SIMPLE ROWS	OTHERS	TOTAL
BUKA	86.6	15.4	0.0	100.0
BUIN	90.2	2.4	7.3	100.0
KIETA	80.0	20.0	0.0	100.0
TOROKINA	100.0	0.0	0.0	100.0
KUNUA	93.3	6.7	0.0	100.0
SIWAI	95.1	0.0	4.9	100.0
BANA	92.3	7.7	0.0	100.0
SELAU	28.6	71.4	0.0	100.0
TINPUTS	100.0	0.0	0.0	100.0
WAKUNAI	91.3	8.7	0.0	100.0
NISSAN	100.0	0.0	0.0	100.0
BOUGAINVILLE	86.9	12.0	1.1	100.0

$$X^2 = 76.35, 20 \text{ d.f.}$$

COCONUT : SPACING USED IN PLANTING

Over two-thirds (70%) of coconut growers claimed to use triangular/square method in planting. In fact in Torokina, Buin, Tinputz, Wakunai and Nissan this method was used exclusively. Across the province over one quarter (29.1%) used Simple-rows. Other methods were only used in Buka District. The 3.3% of Buka District growers who used other methods averaged out to only 0.8% of the entire sample of coconut growers in Bougainville.

The chi-square value of 20 degrees of freedom shows that there is a significant difference between districts in the proportion of spacing types/planting arrangements used.

TABLE 17 – COCONUT : SPACING USED IN PLANTING (PERCENTAGE)

DISTRICTS	COCONUT			
	TRIANGULAR SQUARE	SIMPLE ROWS	OTHERS	TOTAL
BUKA	86.7	10.0	3.3	100.0
BUIN	14.3	85.7	0.0	100.0
KIETA	55.6	44.4	0.0	100.0
TOROKINA	100.0	0.0	0.0	100.0
KUNUA	92.9	7.1	0.0	100.0
SIWAI	75.0	25.0	0.0	100.0
BANA	100.0	0.0	0.0	100.0
SELAU	38.5	61.5	0.0	100.0
TINPUTS	38.5	61.5	0.0	100.0
WAKUNAI	100.0	0.0	0.0	100.0
NISSAN	100.0	0.0	0.0	100.0
BOUGAINVILLE	70.1	29.1	0.8	100.0

$$X^2 = 45.91, 20 \text{ d.f.}$$

TABLE 18 – COCOA - CONDITION OF COCOA BLOCK (S), AVAILABILITY OF TOOLS AND GROWERS INTENTION TO CLEANING COCOA BLOCKS SOON

DISTRICT	COCOA							
	CLEANED		WILLING TO CLEAN SOON		PRUNED		APPROPRIATE TOOLS	
	YES	NO	YES	NO	YES	NO	YES	NO
BUKA	92.3	7.7	92.3	7.7	65.4	34.4	42.3	57.7
BUIN	100.0	0.0	100.0	0.0	95.1	4.9	17.1	82.9
KIETA	84.0	16.0	96.0	4.0	52.0	48.0	8.0	92.0
TOROKINA	100.0	0.0	100.0	0.0	87.5	12.5	0.0	100.0
KUNUA	80.0	20.0	93.3	6.7	86.7	13.3	93.3	6.7
SIWAI	75.6	24.4	100.0	0.0	65.9	34.1	4.9	95.1
BANA	69.2	30.8	92.3	7.7	38.5	61.5	0.0	100.0
SELAU	85.7	14.3	100.0	0.0	92.9	7.1	7.1	92.9
TINPUTS	73.3	26.7	100.0	0.0	60.0	40.0	20.0	80.0
WAKUNAI	100.0	0.0	100.0	0.0	73.9	26.1	17.4	82.6
NISSAN	100.0	0.0	100.0	0.0	50.0	50.0	0.0	100.0
B'VILLE	87.3	12.7	97.6	2.4	69.8	30.2	19.1	80.9

$$X^2 = 23.38, 10 \text{ d.f.} \quad X^2 = 10.28, 10 \text{ d.f.} \quad X^2 = 31.72, 10 \text{ d.f.} \quad X^2 = 74.88, 10 \text{ d.f.}$$

Table 18 indicates the condition of the cocoa blocks, availability of appropriate tools and growers' intention on how soon they intend to clean their cocoa blocks. Five out of every six cocoa growing households had cleaned their blocks. The districts with most cleaned

cocoa blocks were Buin, Torokina, Wakunai and Nissan as all the growers of these districts cleaned their cocoa blocks. The chi-square value shows that there is a significant variation across the districts regarding attitudes about cleaning cocoa blocks.

In regards to the growers' intention on cleaning cocoa block(s) soon, the vast majority of them across the districts (97.6%) said that they were intending to clean their cocoa blocks soon while only (2.4%) responded negatively. No significant variation between districts was evident in this regard.

Table 18 also shows that (69.8%) of the growers pruned their cocoa blocks while (30.2%) did not. Of the latter group, nearly half of the growers of each of the districts of Kieta, Bana, Nissan and Tinputi did not prune their cocoa blocks. There was a variation noticed in pruning of cocoa blocks among the districts except Bana, in which nearly two-thirds of the growers negatively responded. Further analysis showed that there was significant difference in the percentage of opinion on pruning among the districts of Torokina, Wakunai and Nissan as all the growers from these districts cleaned their cocoa blocks. The chi-square value showed that there was significant variation in the opinion on cleaning of cocoa blocks across the districts.

In regards to the growers' intention to clean cocoa blocks(s) soon, the vast majority of them across the districts (97.6%) said that they were intending to clean their cocoa blocks soon while only (2.4%) responded negatively. No significant variation between districts was evident in this regards.

When asked if they had appropriate tools to prune/clean cocoa trees, less than one-fifth (19.1%) of the growers said that they had appropriate tools while four out of every five growers (80.9%) mentioned that they did not (Table 18). The chi-square value indicates that across the districts, there was a significant variation in the percentage of respondents possessing appropriate tools.

TABLE 19 -- COCOA: WHERE LEARNED PRUNING (PERCENTAGE)

DISTRICT	COCOA					
	SELF	EX. OFFICER	NEIGHBOUR	P'TATION	OTHERS	TOTAL
BUKA	70.6	17.6	11.8	0.0	0.0	100.0
BUIN	28.2	51.3	20.5	0.0	0.0	100.0
KIETA	53.8	46.2	0.0	0.0	0.0	100.0
TOROKINA	42.9	57.1	0.0	0.0	0.0	100.0
KUNUA	15.4	84.6	0.0	0.0	0.0	100.0
SIWAI	40.7	59.3	0.0	0.0	0.0	100.0
BANA	40.0	60.0	0.0	0.0	0.0	100.0
SELAU	69.2	7.7	23.1	0.0	0.0	100.0
TINPUTZ	33.3	44.4	22.2	0.0	0.0	100.0
WAKUNAI	29.4	70.6	0.0	0.0	0.0	100.0
NISSAN	0.0	0.0	0.0	0.0	100.0	100.0
BOUGAINVILLE	38.5	45.3	7.1	0.0	9.1	100.0

$$\chi^2 = 43.30, 20 \text{ d.f.}$$

Those who pruned their cocoa blocks were further asked where they had learnt about pruning. Table 19 shows that forty five per cent (45%) of the growers reported that they learned how to prune from DPI Extension Officers, while over one-third (38.5%) said that they learned by themselves and the rest learnt from neighbors and others. We also asked for reasons for not pruning cocoa blocks. Forty-two per cent (42.4%) of the growers, who did not prune, said that they did not know how to prune. One-third (33.2%) of them said that they did not think about it while nearly one quarter (24.3%) stated other reasons (Table 20). There was also a significant variation in the response to these questions from growers from different districts.

TABLE 20 -- COCOA: REASONS FOR NOT PRUNING (PERCENTAGE)

DISTRICT	COCOA			
	DO NOT KNOW	DO NOT THINK	OTHERS	TOTAL
BUKA	33.3	22.2	44.4	100.0
BUIN	0.0	100.0	0.0	100.0
KIETA	25.0	66.7	8.3	100.0
TOROKINA	0.0	100.0	0.0	100.0
KUNUA	50.0	0.0	50.0	100.0
SIWAI	50.0	14.3	35.7	100.0
BANA	25.0	12.5	62.5	100.0
SELAU	100.0	0.0	0.0	100.0
TINPUTZ	33.3	33.3	33.3	100.0
WAKUNAI	50.0	16.7	33.3	100.0
NISSAN	100.0	0.0	0.0	100.0
BOUGAINVILLE	42.4	45.3	24.3	100.0

$$\chi^2 = 25.46, 20 \text{ d.f.}$$

TABLE 21 -- COCOA: FERMENTARY, REG. NUMBER, DEALER'S LICENSE AND CONDITION OF FERMENTARY

DISTRICTS	COCOA					
	OWNED FERMENTARY		DEALER'S LICENSE		FERMENTARY OPERATING	
	YES	NO	YES	NO	YES	NO
BUKA	3.8	96.2	100.0	0.0	0.0	100.0
BUIN	65.9	34.1	70.4	29.6	3.7	96.3
KIETA	24.0	76.0	83.3	16.7	16.7	83.3
TOROKINA	37.5	62.5	33.3	66.7	33.3	66.7
KUNUA	26.7	73.3	75.0	25.0	25.0	75.0
SIWAI	48.8	51.2	85.0	15.0	35.0	65.0
BANA	53.8	46.2	14.3	85.7	0.0	100.0
SELAU	14.3	85.7	100.0	0.0	100.0	0.0
TINPUTS	66.7	33.3	10.0	90.0	80.0	20.0
WAKUNAI	47.8	52.2	54.5	45.5	63.6	36.4
NISSAN	50.0	50.0	100.0	0.0	0.0	100.0
BOUGAINVILLE	39.9	60.1	66.0	34.0	32.5	67.5

$$X^2 = 40.16, 10 \text{ d.f.} \quad X^2 = 28.73, 10 \text{ d.f.} \quad X^2 = 36.83, 10 \text{ d.f.}$$

When asked about fermentary ownership, registration number, Dealer's license and condition of the fermentary, about forty per cent (39.9%) of the growers said that they owned fermentaries, while sixty per cent said that they did not (Table 21). However, more than half of the growers from Buin, Bana, Tinputis and Nissan districts indicated that they did own fermentaries. We found that there was significant difference in percentage of growers owning fermentaries from district to district.

We asked those who owned fermentaries if their fermentaries were still operating. A majority of them (67.5%) responded negatively while one-third stated that their fermentaries were still operating (Table 21). The value of chi-square suggests that there was a variation across the districts in the response to whether the fermentaries were still operating.

**TABLE 22 — COCOA : REASONS FOR FERMENTARY NOT OPERATING
(PERCENTAGE)**

DISTRICTS	COCONUT FERMENTARY			
	BROKEN PIPES	NO FUEL	DESTROYED DURING CRISIS	TOTAL
BUKA	0.0	0.0	100.0	100.0
BUIN	38.5	7.7	53.8	100.0
KIETA	0.0	0.0	100.0	100.0
TOROKINA	0.0	0.0	100.0	100.0
KUNUA	0.0	0.0	100.0	100.0
SIWAI	23.1	15.4	61.5	100.0
BANA	0.0	14.3	85.7	100.0
SELAU	0.0	0.0	0.0	0.0
TINPUTS	0.0	0.0	100.0	100.0
WAKUNAI	25.0	25.0	50.0	100.0
NISSAN	0.0	0.0	0.0	0.0
BOUGAINVILLE	22.2	9.5	68.3	100.0

$$X^2 = 13.8, 20 \text{ d.f.}$$

To those who responded negatively, we further asked them why their fermentaries were not operating. Over two-third (68.3%) of the respondents said that their fermentaries were destroyed during the crisis (Table 22). This is plausible because most of the growers left their homes and properties for the Care Centres or some other places during the crisis. Less than one quarter mentioned broken pipes as the cause of not operating and (9.5%) stated other reasons.

Two-thirds (66%) of the growers reported that they possessed a dealer's license.

We also tried to find out whether there was any significant difference between districts in the responses provided by the growers regarding the operative status of their fermentaries. No difference was found in the percentage of the reasons for fermentaries not operating from district to district.

TABLE 23 -- COCOA : NUMBER OF TREES DAMAGED BY INSECTS AND DISEASES (PERCENTAGE)

DISTRICT	COCOA TREES DAMAGED		PARTS OF THE TREES DAMAGED								
	YES	NO	LEAVES	ROOTS	BRANCHES	TRUNK	ROOTS/LEAVES	ROOTS/BRANCHES	LEAVES/BRANCHES	TRUNK/LEAVES	TOTAL
BUKA	57.7	42.3	13.3	0.0	0.0	26.7	6.7	13.3	20.0	20.0	100.0
BUIN	95.1	4.9	0.0	0.0	0.0	17.9	17.9	23.1	12.8	28.2	100.0
KIETA	84.0	16.0	4.8	0.0	0.0	9.5	14.3	28.6	19.0	23.8	100.0
TOROKINA	100.0	0.0	0.0	0.0	0.0	0.0	25.0	50.0	12.5	12.5	100.0
KUNUA	53.3	46.7	12.5	0.0	0.0	0.0	25.0	37.5	12.5	12.5	100.0
SIWAI	97.6	2.4	0.0	0.0	0.0	12.5	27.5	22.5	15.0	22.5	100.0
BANA	61.5	38.5	12.5	0.0	0.0	0.0	0.0	12.5	50.0	12.5	100.0
SELAU	100.0	0.0	0.0	0.0	0.0	7.1	7.1	21.4	28.6	28.6	100.0
TINPUTS	93.3	6.7	0.0	0.0	0.0	0.0	7.1	21.4	28.6	42.9	100.0
WAKUNAI	95.7	4.3	0.0	0.0	0.0	18.2	13.6	36.4	13.6	13.6	100.0
NISSAN	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0
B'VILLE	85.7	14.3	2.6	0.0	1.6	12.0	16.2	25.1	18.3	24.1	100.0

$$X^2 = 49.82, 10 \text{ d.f.}$$

$$X^2 = 70.01, 40 \text{ d.f.}$$

Table 23 present's data regarding growers' opinion on the trees damaged by insects and diseases. (85.7%) of the cocoa growers said that their trees were damaged by the insects and diseases while (14.3%) said that their trees sustained no damage. Variation between districts regarding responses to this question was highly significant as the value of chi-square indicated. We asked respondents to specify which parts of the trees were affected or damaged. One quarter of the growers who said that their trees were damaged said that roots/branches were the parts mostly damaged while nearly similar numbers of growers reported trunk and leaves. About (20%) of growers mentioned leaves/branches when (16.2%) growers stated trunk only. District-wise, half of the growers from Bana district mentioned that leaves/branches were the major parts of their trees damaged while over forty per cent from Tinput's district specified trunk/leaves. Likewise, growers from Torokina, Kunua and Wakunai districts reported that roots/branches were the parts of the trees most affected while Buka, Buin, and Siwai districts reported trunk only.

We also tried to find out if there was any variation in the response of growers regarding damage to their trees across the districts. We found significant differences between districts in the percentage of growers reporting on damage to different tree parts.

TABLE 24 — COCONUT: NUMBER OF TREES DAMAGED BY INSECTS AND DISEASES (PERCENTAGE)

DISTRICT	COCONUT TREES DAMAGED		PARTS OF TREES DAMAGED							
	YES	NO	LEAVES	NUTS	TRUNKS	ROOTS	SHOOTS	LEAVES/ROOTS	LEAVES/NUTS	TOTAL
BUKA	60.0	40.0	55.6	0.0	0.0	5.6	22.2	11.1	5.6	100.0
BUIN	14.3	85.7	0.0	0.0	100.0	0.0	0.0	0.0	0.0	100.0
KIETA	33.3	66.7	33.3	16.7	0.0	0.0	50.0	0.0	0.0	100.0
TOROKINA	25.0	75.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
KUNUA	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SIWAI	8.3	91.7	0.0	0.0	0.0	0.0	0.0	100.0	0.0	100.0
BANA	40.0	60.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
SELAU	76.9	23.1	10.0	0.0	30.0	10.0	40.0	0.0	10.0	100.0
TINPUTS	46.2	53.8	83.3	0.0	0.0	0.0	0.0	16.7	0.0	100.0
WAKUNAI	11.1	88.9	0.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
NISSAN	100.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
B'VILLE	37.8	62.2	47.9	2.1	8.3	4.2	25.0	8.3	4.2	100.0

$$X^2 = 36.18.10 \text{ d.f.}$$

$$X^2 = 16.95.60 \text{ d.f.}$$

COCONUT TREES DAMAGED BY INSECTS AND DISEASES

In the case of insect and disease damage to coconut palms, the situation was somewhat different. As table 24 indicates, about one-third (37.8%) of the coconut growers indicated that their trees were damaged by insects and diseases. (47.9%) of the growers identified coconut leaves as palm part most often damaged. Shoots were reported to be the next most often affected (25.0%), followed by roots and leaves/nuts. Growers from Buka, Torokina, Bana, Tinputis and Nissan districts mentioned coconut leaves as being the part most affected by the insects and diseases while growers in Wakunai, Selau and Kieta districts stated shoots were the most affected parts. Further analysis showed that there was a significant variation in the responses to this question across the districts.

TABLE 25 — COCOA: NUMBER OF SEEDLINGS DAMAGED BY INSECTS AND DISEASE (PERCENTAGE)

DISTRICT	COCOA SEEDLINGS DAMAGED		PARTS OF THE SEEDLINGS DAMAGED								
	YES	NO	LEAVES	ROOTS	BRANCHES	TRUNK	ROOTS/ LEAVE S	ROOTS/ BRANCHES	LEAVES/ BRANCHES	TRUNK/ LEAVE S	TOTAL
BUKA	38.5	61.5	20.0	0.0	10.0	10.0	10.0	20.0	10.0	20.0	100.0
BUIN	61.0	39.0	36.0	0.0	0.0	8.0	8.0	8.0	8.0	32.0	100.0
KIETA	60.0	40.0	20.0	0.0	0.0	0.0	6.7	6.7	13.3	53.3	100.0
TOROKINA	37.5	62.5	33.3	0.0	0.0	0.0	33.3	0.0	0.0	33.3	100.0
KUNUA	46.7	53.3	0.0	0.0	0.0	28.6	14.3	0.0	28.6	28.6	100.0
SIWAI	58.5	41.5	20.8	0.0	4.2	4.2	8.3	20.8	16.7	25.0	100.0
BANA	69.2	30.8	44.4	11.1	22.2	0.0	11.1	11.1	0.0	0.0	100.0
SELAU	85.7	14.3	33.3	8.3	16.7	8.3	8.3	25.0	0.0	0.0	100.0
TINPUTS	40.0	60.0	83.3	0.0	0.0	16.7	0.0	0.0	0.0	0.0	100.0
WAKUNAI	69.6	30.4	6.3	0.0	0.0	0.0	6.3	18.8	31.3	37.5	100.0
NISSAN	50.0	50.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
B'VILLE	57.4	42.6	27.3	1.6	4.7	6.3	8.6	13.3	12.5	25.8	100.0

$$X^2 = 14.75.10 \text{ d.f.}$$

$$X^2 = 83.32.10 \text{ d.f.}$$

COCOA SEEDLINGS DAMAGED BY INSECTS AND DISEASES

When we inquired about cocoa seedlings, over half (57.4%) of the cocoa growers said that seedlings were also affected by insects and diseases while (42.6%) said that their seedlings were not affected. There was not much variation in these percentages regarding this question across the districts. The chi-square test value is insignificant.

Those who reported insect and disease damage to cocoa seedlings were further asked which parts of the trees were damaged? Leaves were the most often affected parts as reported by over one quarter of the growers while one quarter nominated trunk/leaves and around thirteen percent reported roots, leaves and branches. Table 25 also indicates that there is district dependent variation. Leaves were the most often damaged parts of the trees identified by the growers from Buka, Buin, Tinputis and Nissan districts, while growers in Kieta, Kunua, Torokina and Wakunai districts specified trunks and leaves as being most damaged by insects and diseases.

TABLE 26 – COCONUT: SEEDLINGS DAMAGED BY INSECTS AND DISEASES (PERCENTAGE)

DISTRICT	COCONUT SEEDLINGS DAMAGED		PARTS OF THE SEEDLINGS DAMAGED		
	YES	NO	LEAVES	LEAVES/ ROOTS	TOTAL
BUKA	10.0	90.0	33.3	66.7	100.0
BUIN	0.0	100.0	0.0	0.0	0.0
KIETA	11.1	88.9	100.0	0.0	100.0
TOROKINA	0.0	100.0	0.0	0.0	0.0
KUNUA	0.0	100.0	0.0	0.0	0.0
SIWAI	8.3	91.7	0.0	100.0	100.0
BANA	20.0	80.0	100.0	0.0	100.0
SELAU	69.2	30.8	33.3	66.7	100.0
TINPUTS	7.7	92.3	0.0	100.0	100.0
WAKUNAI	11.1	88.9	100.0	0.0	100.0
NISSAN	0.0	100.0	0.0	0.0	0.0
BOUGAINVILLE	14.2	85.8	44.4	55.6	100.0

$$X^2 = 38.42, 10 \text{ d.f.} \quad X^2 = 30.90, 10 \text{ d.f.}$$

COCONUT SEEDLINGS DAMAGED BY INSECTS AND DISEASES

The number of coconut seedlings damaged by insects and diseases was not as high as that for cocoa, as only (14.2%) of the coconut growers reported such damages (as presented in Table 26). We questioned those who reported damage about which parts of the seedlings were damaged. Over fifty per cent (55.6%) of the growers said that leaves and roots were the parts most damaged while (44.4%) mentioned leaves only.

The chi-square test indicated that there was a large variation in the response of which parts of the trees were damaged depending on district. While growers in Buka, Siwai, Selau and Tinputz districts specified leaves and roots as the most affected parts of the trees, growers from Kieta, Bana and Wakunai identified leaves only.

GROWERS OPINION ON CLEANING COCONUT BLOCK(S)

TABLE 27 – COCONUT : OPINION ON CLEANING BLOCKS (PERCENTAGE)

DISTRICTS	OPINION		WITHIN 3 MONTHS	WITHIN 6 MONTHS	WITHIN 12 MONTHS	OTHERS	APPROPRIATE TOOLS	
	YES	NO					YES	NO
BUKA	96.7	3.3	51.7	20.7	6.9	20.7	86.7	13.3
BUIN	85.7	14.3	0.0	33.3	50.0	16.7	57.1	42.9
KIETA	94.4	5.6	35.3	58.8	0.0	5.9	50.0	50.0
TOROKINA	100.0	0.0	25.0	50.0	25.0	0.0	0.0	100.0
KUNUA	92.9	7.1	84.6	15.4	0.0	0.0	78.6	21.4
SIWAI	83.3	16.7	80.0	10.0	10.0	0.0	50.0	50.0
BANA	100.0	0.0	40.0	20.0	40.0	0.0	20.0	80.0
SELAU	100.0	0.0	46.2	23.1	7.7	23.1	84.6	15.4
TINPUTS	92.3	7.7	33.3	16.7	16.7	33.3	69.2	30.8
WAKUNAI	100.0	0.0	44.4	33.3	11.1	11.1	66.7	33.3
NISSAN	100.0	0.0	50.0	50.0	0.0	0.0	100.0	0.0
B'VILLE	94.5	5.5	48.3	27.5	10.8	13.3	66.9	33.1

When growers were asked if they were intending to clean coconut block(s) soon, over ninety per cent (94.5%) said that they were. How soon do you intend to clean? Of these (48.3%) said that they would clean their blocks within three months while a little over one quarter (27.5%) stated that they would clean within six months. Across the district, the response as to how soon they intended to clean their blocks varied considerably from one to the other as the value of chi-square indicated in Table 27.

Growers were asked if they had the appropriate tools to clean their coconut block(s)? Unlike the situation with cocoa growers, an overwhelming majority of coconut growers (66.9%) reported that they did have appropriate tools. Table 27 shows that there was no significant difference in the percentage of responses on growers with appropriate tools across the districts.

COCONUT : USE OF FERTILIZERS

We also question growers regarding whether they used fertilisers to grow coconuts or not. There was no indication of any coconut-growing household using fertilisers. This might have been because of soil and climate across the districts, which were very favourable to growing coconuts. However, when asked for reasons for not using fertilisers, (44.1%) of them said that they did not think about using fertilisers while (28.0%) said they did not know about fertilisers and the rest provided other reasons. There is a considerable variation in the percentage of reported reasons for not using fertilisers. While large percentages of the growers from Torokina, Bana, Buin, Tinputs and Kunua districts claimed that they did not think about using fertilisers, the growers from Selau, Nissan, Siwai and Buka said that they did not know how to use them. Growers from Wakunai, Siwai and Buka provided other reasons.

TABLE 28 -- COCONUT : USE OF FERTILIZERS (PERCENTAGE)

DISTRICT	FERTILIZER USED		REASONS FOR NOT USING		
	YES	NO	DON'T KNOW	DON'T THINK	OTHERS
BUKA	0.0	100.0	23.3	30.0	46.7
BUIN	0.0	100.0	0.0	85.7	14.3
KIETA	0.0	100.0	22.2	44.4	33.3
TOROKINA	0.0	100.0	0.0	100.0	0.0
KUNUA	0.0	100.0	35.7	50.0	14.3
SIWAI	0.0	100.0	16.7	41.7	41.7
BANA	0.0	100.0	20.0	80.0	0.0
SELAU	0.0	100.0	61.5	23.1	15.4
TINPUTS	0.0	100.0	38.5	53.8	7.7
WAKUNAI	0.0	100.0	11.1	33.3	55.6
NISSAN	0.0	100.0	100.0	0.0	0.0
BOUGAINVILLE	0.0	100.0	27.6	44.1	28.3

COPRA DRIERS : OWNING, TYPE, CONDITION AND PRODUCER NUMBERS

TABLE 29 – COPRA DRYERS OWNING, TYPE, CONDITION AND PRODUCER NUMBERS (PERCENTAGE)

DISTRICT	OWNED DRYER		TYPE		PRODUCER NUMBER	
	YES	NO	HOT	SMOKE	YES	NO
BUKA	28.57	71.43	0.00	100.00	14.29	85.71
BUIN	40.00	60.00	41.67	58.33	76.67	23.33
KIETA	38.89	61.11	28.57	71.43	27.78	72.22
TOROKINA	100.00	0.00	25.00	75.00	100.00	0.00
KUNUA	64.29	35.71	0.00	100.00	50.00	50.00
SIWAI	16.67	83.33	0.00	100.00	16.67	83.33
BANA	66.67	33.33	16.67	83.33	66.67	33.33
SELAU	30.77	69.23	0.00	100.00	30.77	69.23
TINPUTS	84.62	15.38	0.00	100.00	84.62	15.38
WAKUNAI	20.00	80.00	0.00	100.00	20.00	80.00
NISSAN	100.00	0.00	0.00	100.00	100.00	0.00
BOUGAINVILLE	47.24	52.76	15.00	85.00	51.97	48.03

Table 29 represents the data on percentages of coconut growers who own copra dryers, the dryer and their current types, condition. It indicates that nearly half (47.24%) of the coconut growers own copra dryers while (52.7%) did not. Of those growers who claimed to own a drier, eighty-five per cent (85.0%) of them reported that they had "Smoke" type dryer while rest (15.0%) had the "Hot Air" type. All highest growers from Buka, Kunua, Siwai, Selau, Tinputs, Wakunai and Nissan districts reported that their dryers were of the "Smoke" type. Only in Kieta, Buin, Torokina and Bana district ownership of "Hot Air" dryers reported.

Just over half (51.97%) of the coconut growers said that they had producer numbers.

TABLE 30 -- COPRA DRYERS: REASONS FOR NOT OPERATING

DISTRICT	DRYER STILL OPERATING		BROKEN PIPE & BED	NEED MAJOR REPAIRING	BEYOND REPAIR	OTHERS
	YES	NO				
BUKA	50.0	50.0	0.0	0.0	0.0	100.0
BUIN	91.7	8.3	0.0	0.0	100.0	0.0
KIETA	57.1	42.9	60.0	40.0	0.0	0.0
TOROKINA	50.0	50.0	0.0	0.0	0.0	100.0
KUNUA	88.9	11.1	0.0	0.0	0.0	100.0
SIWAI	0.0	100.0	0.0	0.0	0.0	100.0
BANA	100.0	0.0	0.0	0.0	0.0	0.0
SELAU	100.0	0.0	0.0	0.0	0.0	0.0
TINPUTS	90.9	9.1	100.0	0.0	0.0	0.0
WAKUNAI	0.0	100.0	0.0	0.0	100.0	0.0
NISSAN	50.0	50.0	0.0	0.0	100.0	0.0
BOUGAINVILLE	78.3	21.7	30.8	15.4	23.1	30.8

When dryer owner were asked if their dryers were still operating. Over three-quarter replied that their dryers were indeed still operating those who stated that their dryers were not operating (30.8%) indicated "Broken pipes & bed" as the cause. The same percentage cited other reasons as the main causes for their dryers not operating while nearly one-quarter of them said that their dryers were beyond repair. Only (15.4%) indicated that their dryers required major repairs.

CONCLUSION

This was primarily a baseline survey with the objective of gaining an overall view on the status of the cocoa and copra activities in the province as well as providing an formation on estimates on the number of trees still standing and those that have been destroyed and lost during the nine years of the crisis and the 1997 and 1998 drought. The study also investigated the respondent's opinion on what level of assistance they would require to bring back economic development and normalcy to the lives of the people.

Whilst the sample looks very moderate, there is substantial information gained from this exercise which would be useful to assist in planning a major rehabilitation development programme for the province.

The study has also shown the level of damage done to these crop industries and the impact this has on the economy of the province in general.

RECOMMENDATION

There was virtually no economic service in existence during the crises period. However, as has been seen recently, there is a lot of assistance being directed towards the rehabilitation and development of the province. For this assistance to be properly regulated and directed at appropriate levels to specific areas identified and targeted, a further detailed investigation should be planned. The scope and coverage to be extensive including various developmental and socio-economic aspects of life at large pertaining to agriculture.

This would require a higher level of funding than what had been planned for the current exercise. With a higher level of funding, the coverage and the scope of the exercise would be improved besides better control and execution of the exercise.

REFERENCE LIST

1. Cocoa Board, Cocoa Annual Report 1996 and 1997, Cocoa Board of PNG.
2. DAL/Cocoa Board, cost of Production and Plantation Viability Survey, Final Report, ANZDEC Ltd., May 1991
3. Goldyn .D.L.,An Economic survey of Cocoa in PNG.
Part 3. Village Cocoa, Port Moresby June 1974
4. Hanson, Hurwitz and Meadow,
Survey Sample Methods and Theory Vol.2
5. Kernson, R.E., Statistics For Economics. University of London, Wye College. 1989.
6. Mosleuddin M., Sampling Theory and Application. Statistical Institute for Asia and the Pacific (SIAP) Tokyo, August 1997.
7. PNG Export Tree Crop Study, Volume 2, Largeholder Cocoa Coconut, July 1987.
8. Rural Statistics Section (RSS) Provincial Crops Survey, North Solomons Province.
Department of Primary Industries 1979/88.

APPENDIX

COCOA AND COCONUT BASELINE SURVEY, 1999
BOUGAINVILLE PROVINCE

1. Farmer Details:

Identification Number

1.1 Personal Details

Head of the Household (H/H) _____

D.O.B _____

Village _____

District _____

Enumerator _____

Date of Interview _____

Supervisor _____

Date Checked _____

1.2 Household Details:

Name of H/H Members incl. Head of household	Sex (M/F)	D.O.B	Education				Occupation	
			Nil	Primary	Secondary	Others	Primary	Secondary

Note: Do not include any H/H member(s) permanently living away. Only person(s) living as part of household.

2. CROPS DETAILS

2.1 Cocoa Details

A. Please state number of Cocoa trees you have and details of planting below.

Block	Classification of Trees By Age (Number)			Year of Planting	Area(ha)*
	Bearing	Immature	Senile		
From your own block					
Total block					

Note: Physical check and count of these plantings would be made to confirm these figures.

*Area (ha) to be specified after measuring the blocks.

B. Description of Planting.

Description	Tick
Sole Planting	
Inter-planting with coconuts	
Inter-planting with other crops	

C. Please state the number of trees lost or damaged as a result of 9 years conflict.

Number

D. Please state the number of trees lost or damaged as a result of 1997 drought?

Number

E. Do you have any plans to extend the size of your cocoa block?

Yes No

F. If answer is "Yes", how many more trees do you want to plant?

Number

G. Have you done any new planting or replanting of cocoa in the past 12 months?

Planting	Yes	No
New Planting		
Replanting		

H. If your answer is "Yes", state number of plantings and specify whether ordinary village type or hybrid.

Planting	Type	Source of Seedlings
New Planting		
Replanting		

I. Do you have labour assistance to work in your cocoa block(s)?

Yes

No

J. If "Yes" then provide number and fortnight cost involved

Number	Unit Cost per F/N	Remarks

K. Do you want to replace any old trees?

Yes -

No

L. If answer is "Yes" how many trees would you like to replace and how soon?

How Soo	Tick
3 months	
6 months	
12 months	
Others	

M. Where would you obtain your seedlings?

N. What spacing do you use?

Triangular

Simple Rows

Square

Others

O. Have you cleaned your cocoa block(s) in the last 6 months?
(i.e. shade thinned and cleared bush)

Yes

No

P. Are you intending to clean your cocoa block(s) soon?

Yes

No

Q. Do you prune or maintain your cocoa trees?

Yes

No

R. If answer is "Yes" , where did you learn about pruning?

Where Learned	Tick
Self	
Extension Officer	
Neighbour	

S. If answer is "No" then why don't you prune?

Answer	Tick
Do not know	
Do not think about it	
Others	

T. Do you have appropriate tools to prune/clean cocoa trees?

Yes

No

U. Do you own a fermentry?

Yes

No

V. If answer is ' Yes ' then please provide name and registration number.

Name

Registration
Number

W. Do you have a Dealer's License?

Yes

No

X. Is your fermentry still operating?

Yes

No

Y. If answer is "No" please give reason(s)

Z. Do you experience any damage of insects and diseases to your cocoa trees?

Yes

No

AA. If answer is "Yes" which part(s) of the trees?

Parts	Tick
Leaves	
Roots	
Branches	
Trunk	
Others	

AB. Do you experience any insect damage and disease problems with your seedlings?

Yes

No

AC. If answer is "Yes" then which part(s) of seedlings?

Parts	Tick
Leaves	
Roots	
Branches	
Trunk	
Others	

2.2 Coconut Details

A. Please state number of Coconut trees you have.

Block	Classification of Trees By Age			Year of Planting	Area(ha)*
	Bearing	Immature	Senile		
From your own block					
Total block					

Note: Physical check up and count of these plantings would be made to confirm these figures.

*Area (ha) to be specified after measuring the blocks.

B. Description of Planting.

Description	Tick
Sole Planting	
Inter-planting with cocoa	
Inter-planting with other crops	

C. Please state the number of trees lost or damaged as a result of 9 years conflict.

Number

D. Please state the number of trees lost or damaged as a result of 1997 drought.

Number

E. Do you have any plans to extend the size of your coconut block?

Yes

No

F. If answer is "Yes", How many more trees do you want to plant.

Number

G. Have you done any new planting or replanting of coconuts in the past 12 month?

Planting	Yes	No
New Planting		
Replanting		

H. If answer is "Yes", state number of plantings and specify whether ordinary village type or hybrid.

Planting	Type	Number of Trees	Source of Planting materials
New Planting			
Replanting			

I. What spacing do you use?

Triangular

Simple Rows

Square

Others

J. Do you have labour assistance to work in your coconut block(s)?

Yes

No

K. If "Yes" then provide details of labour and any costs involved

Class	Number	F/N Costs per unit	Remarks
Family			
Hired			
Others			
Total			

L. If answer is "No" then, are you intending to clean your coconut block(s)

Yes

No

M. If answer to Q.N is "Yes" then state how soon.

How Soo	Tick
3 mnths	
6mnths	
12mnths	
others	

N. Do you want to replace any old trees?

Yes

No

O. If answer is "Yes" how many trees would you like to replace and how soon?

Number

How Soon	Tick
3 mnths	
6mnths	
12mnths	
others	

P. Where would you obtain your seed nuts ?

Q. Do you fertilise your coconut trees?

Yes

No

R. If answer is "Yes", where did you learn how to use fertilisers?

How Learned	Tick
Self	
Extension Officer	
Neighbour	

S. If answer is "No" then why don't you use fertilisers?

Answer	Tick
Do not know how	
Do not know about it	
Others	

T. Do you have appropriate tools to clean your block?

Yes ☐ No ☐

U. Do you own a copra dryer?

Yes ☐ No ☐

V. If answer to Q. W. is yes, please state type

Type	Tick
Hot Air	
Smoke	
Others	

W. Please provide Producer Number.

Number

X. Is your dryer still operating _____

Y. If answer is "No" please give detail(s) _____

Z. Do you experience any insects or diseases damage to your coconut trees?

Yes ☐ No ☐

AA. If answer is "Yes" which part(s) of the trees?

Parts	Tick
Leaves	
Nuts	
Trunk	
Others	

AB. Do you experience any disease problems with your seedlings?

Yes ☐ No ☐

AC. If answer is "Yes" then which part(s) of seedlings?

Parts	Tick
Parts	Tick
Leaves	
Roots	
Trunk	
Others	